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INSTRUCTION BOOK
FOR
TELEPHONE TP-3-TI
(SOUND POWERED)

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INSTRUCTION BOOK
FOR
TELEPHONE TP-3-T1
(Sound Powered)

R E S T R I C T E D

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INSTRUCTION BOOK
FOR
TELEPHONE TP-3-T1
(Sound Powered)

229142 013

SECTION I - 270 014

GENERAL DESCRIPTION - 68 cap 012

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1

1. Use. Telephone TP-3-T1 provides two-way signaling and voice communication without the use of batteries. Telephones of this type are designated as sound-powered telephones. Telephone TP-3-T1 may be connected by metallic or grounded circuits composed of field wire, open-wire lines, or cable to the following types of circuits and equipment:

- 68
- Sound-powered telephones
 - Local-battery (magneto) telephones
 - Local-battery (magneto) telephone switchboards.
 - Two-way ring-down trunk circuits of common-battery telephone switchboards
 - Common-battery line circuits of common-battery telephone switchboards (See subparagraph 4b for limitations on this use.)

2. Major Components. The telephone comprises the assembly of three major items; i.e., a telephone set box, a sound-powered handset with cord, and a leather case with carrying strap. The telephone set box is placed in one side of the leather case and the remaining space forms a compartment for the handset. The overall dimensions are approximately 9-3/8 inches high by 7-1/4 inches wide by 3-1/2 inches deep. The telephone set box consists of an inclosed aluminum-alloy frame chassis presenting a terminal panel on the top side. A hand generator, ringer, and two capacitors are mounted within the frame chassis.

SECTION II

EMPLOYMENT

3. Installation. The telephone should be installed in a manner providing convenient access to the handset and the generator handle. The telephone may be suspended from a tree trunk or tent pole by means of the strap, but should be firmly tied to the support to prevent swinging. In this case the straps may be so formed as not to interfere with operation. As a matter of convenience the cover of

the telephone may remain closed and the handset hung suspended in the flexible leather cradle.

a. Connecting the Telephone to a Line. In connecting the telephone to a line terminated at the far end at a switchboard or by another telephone, connect each of the two conductors of the line wire to the Binding Posts L-1 and L-2 respectively. Be sure that tight, clean connections are made.

b. Testing the Installation. The talking and ringing circuits should now be tested through to the station at the far end of the line for satisfactory operation. Ring the distant station by rotating the hand-generator crank and hold a short check conversation. Request the distant station to ring back. The generator should turn very hard with the line terminals shorted. As a further check of the generator, the generator output can be **heard** in the handset receiver regardless of whether or not the line is open.

c. Handset Connections. Plug PL-58 is used with the handset jack to connect an extra Handset TS-10. The middle prong of Plug PL-58 and jack opening are not used for an electrical connection when used with this telephone. The binding posts associated with the handset jack permit direct terminal connection of the handset cord if desired. Either conductor of the handset cord may be connected to either handset binding post.

4. Operation.

a. When Connected to Other Sound Powered Telephones, Local Battery (Magneto) Telephones, Local Battery (Magneto) Switchboards and Two Way Ring-Down-Trunk-Circuits of Common Battery Switchboards.

(1) To Call. Rotate the generator crank rapidly in a clockwise direction several revolutions. Repeat if your signal is not answered.

(2) To Talk and Listen. Speak distinctly into the transmitter with the lips close to the mouthpiece, and the receiver held firmly to the ear.

(3) To Ring Off. Upon completing a call through a distant switchboard, ring off by rotating the generator crank rapidly in a clockwise direction several revolutions. This operates the switchboard supervisory drop and informs the operator that the call has been completed.

b. Common Battery Use. This telephone was not designed to provide common-battery supervision. However, condensers are provided in series with the ringer and handset so that the telephone may, in an emergency, be connected to common-battery lines without causing a permanent signal at the switchboard. The line lamp on the common-battery switchboard may be flashed by slowly and intermittently short circuiting the telephone-line

binding posts. As the switchboard operator will not receive the usual supervision while the conversation is being held, the switchboard operator should be instructed not to take down the connection until the supervisory signal is flashed on and off. At the completion of the call flash the supervisory signal at the switchboard by slowly and intermittently short circuiting the telephone-line binding posts.

5. Maintenance. The telephone is sturdily built and with reasonable care should give a maximum of service with a minimum of trouble. The telephone should be tested periodically for satisfactory operation of all features. These tests can be expedited by connecting two telephones together by short line wires and testing the two jointly. The following list is a summary of the most likely troubles that may be experienced and suggestions for their correction, after having determined that all line or switchboard trouble has been cleared.

a. Signaling.

(1) Ringer does not operate. First, examine the generator shunt springs and contacts and if necessary adjust and clean same. Second, check wiring circuit through the capacitor and ringer coils for grounds to metal frame, short circuits, and continuity. Third, adjust the ringer.

(2) Generator does not deliver output to line. Inspect and if necessary adjust and clean the generator shunt-spring contacts. Check wiring for opens, shorts and grounds. The generator is lubricated with a nonfluid lubricant, and none other should be used.

b. Talking and Listening.

(1) Telephones fail to operate when talking or listening. Check wiring and cords for continuity, short circuits, and grounds. The transmitter and receiver may be tested by talking into the receiver and listening in the transmitter to determine which is at fault, the transmitter of one telephone or the receiver of the other telephone. If only one telephone is available, connect a 1-1/2 volt battery in series with approximately 1000 ohms to the handset terminals. A distant click should be heard in both the transmitter and receiver when the circuit is made and broken. When the circuit to the battery is closed and the cord shaken, noise in the transmitter or receiver indicates a loose connection or a defective cord.

SECTION III

DETAILED DESCRIPTION AND FUNCTIONING OF PARTS

6. Case. The case is identical with the case used for Telephone EE-8. The case is made of leather sewed at the corners, with a hinged cover formed by extending the leather of the back of the case. The cover is held closed by a "Lift-the-Dot" fastener. An adjustable strap is provided for carrying, which by extending under the case acts also as a reinforcement. A metal-faced opening is provided on the right side

of the case for the hand-generator crank handle. A cradle section of flexible leather is located in the top of the cover so that the cover may remain closed and the handset hung suspended by placing the receiver end of the handset in the cradle. The telephone set box is held in the case by seven machine screws and placed at the right of the case leaving a compartment to the left for receipt of the handset and cord.

7. Frame Chassis. The metal frame chassis is identical with the metal frame chassis of Telephone EE-8. The frame chassis is a box-like structure of aluminum alloy upon and within which all components of the telephone equipment, exclusive of the handset, are mounted. The top of the box structure is closed by the terminal panel (paragraph 9). The aluminum-alloy side plates and the bottom plate are held in place by machine screws and hence are readily removable for repairs or inspection of the equipment. The frame chassis is finished dull black. A wiring diagram and a schematic diagram are attached to the exterior plates.

8. Handset TS-10. The handset has the appearance of the prevalent commercial type comprising a handle, transmitter unit, receiver unit and cord.

a. Handle. The handset handle is molded of high-strength phenolic-base compound material presenting a cavity at one end for the transmitter unit and a cavity at the other end for the receiver unit.

b. Transmitter. The transmitter consists of a transmitter unit mounted in the handset cavity and locked in position by a molded phenolic-base compound cap and a metal locking ring. The transmitter unit is the magnetic sound-powered type and does not require any power other than the power of the speaker's voice. As the average speech power is only 15 microwatts, it is apparent that it is necessary to speak with the lips close to the mouthpiece to utilize efficiently the small amount of available energy. By referring to Figure 5 it may be seen that when acoustical power drives the diaphragm downward, the righthand end of the pivoted armature approaches the north pole of the magnet and the lefthand end approaches the south pole causing the passage of a magnetic flux from the righthand north pole through the armature to the lefthand south pole. When the diaphragm shown in Figure 5 moves upward the lefthand end of the armature approaches the north pole and the righthand end approaches the south pole, causing the passage of a magnetic flux from the lefthand north pole through the armature to the righthand south pole. This reversal of direction of the flux in the armature induces an alternating current in the winding which surrounds the armature.

c. Receiver. The receiver consists of a receiver unit mounted in the receiver cavity and locked in position by a molded phenolic-base compound cap and a metal locking ring. The receiver unit is the same magnetic type as the transmitter unit. However, the units are not interchangeable as

the acoustical openings over the diaphragms are different. The units are arranged so that they cannot be inserted in the wrong cavity. As the power output of the sound-powered transmitter is very small this deficiency is made up in part by making the receivers more sensitive than the receivers used with battery-powered telephones. The receivers used with sound-powered telephones are sensitive to signals 10-db lower than are the receivers used with battery-powered telephones. By referring to Figure 5 it may be seen that when the alternating current from the distant telephone is applied to the winding of the receiver, the armature will become magnetized. As an example when the current is in such direction that a north pole is induced at the righthand end of the armature and a south pole at the lefthand end, the righthand end of the armature will move downward and the lefthand end will move upward, driving the diaphragm upward. When the current changes in direction, the poles in the armature will reverse, causing the diaphragm to move downward.

d. Cord. The cord is 6 feet long and is composed of two rubber-insulated, stranded-copper wire conductors twisted together and covered with a rubber jacket. The handset termination is by means of spade terminals in the transmitter cavity of the handset and includes a tie-cord for holding the cord in place. In replacing a cord, unscrew the transmitter locking ring and remove the mouthpiece and the transmitter unit, whereupon access is had to the cord terminals. It is also necessary to remove the round packing-gland nut through which the cord enters the handset. The telephone end of the cord is provided with spade terminals and a tie-cord for connection to the telephone binding posts or to Plug PL-58.

9. Terminal Panel. See Figures 2, 3 and 4. The terminal panel is made of high-strength, laminated and molded phenolic-base compounds. Two binding posts designated L-1 and L-2 are provided for connection to line wires. Two screw terminals are provided for connection to the handset cord and a screw eye is provided for the tie-cord. These two terminals are also in parallel with the contacting members of a jack which accommodates Plug PL-58. Hence an extra handset or head and chest set may be used by means of the plug-and-jack arrangement. The Plug PL-58 is not furnished as a part of the telephone.

10. Generator GN-38 and Crank GC-9. This hand generator is for the purpose of operating the ringer of the distant telephone, or operating the line or supervisory drop of a local-battery (magneto) switchboard or the ring-down relays in the trunk circuits in other types of switchboards. The crank is placed at the right of the telephone case and when not in use hinges back automatically into a recess. In signaling, the crank should be rotated in a clockwise direction for several revolutions. The crank should turn freely, and if not, this condition is usually an indication of an overload such as a short-circuited line.

The generator comprises three small cobalt-steel permanent magnets arranged in parallel on two pole faces about an armature. The armature has a resistance of about 400 ohms. The armature is gear driven by the crank, the gear ratio being 21 to 99 respectively. The bearings are lubricated by a nonfluid lubricant. The generator is provided with shunt spring contacts which in normal position connect the ringer across the line, and upon rotation of the crank handle, disconnect the ringer and connect the generator armature across the line. (See Figures 6 and 7.) The specified minimum alternating-current output of the generator at an armature speed of 1000 revolutions per minute, which corresponds to 212 revolutions per minute of the crank, is as follows:

<u>Resistance of Load in Ohms</u>	<u>Output in Milliamperes</u>
200	81
1000	45
10000	8.5
100000	0.9

As the generator has two poles, the frequency at 1000 revolutions per minute is $16\frac{2}{3}$ cycles per second. The Generator GN-38 is also used in Telephone EE-8 and Switchboards BD-71 and BD-72.

11. Ringer MC-131. The ringer produces an audible signal indicative of a call. The ringer is of the single-gong type in which the ringer coils, armature, and clapper are mounted internal to the gong. Upon the coils being energized by 16 to 20-cycle alternating current, the armature operates the clapper about a pivot to strike alternate internal projections on the gong rim. The acoustical output is distributed unevenly over the frequency band of 0 to 9900 cycles per second. When installed in the telephone, the greater part of the acoustical output is below 4500 cycles per second. The inductance is about 3 henries, the impedance at 1000 cycles is about 20,000 ohms; hence the voice-frequency bridging loss occasioned by the ringer is negligible. The acoustical output is high for a relatively low electrical input, provided the ringer is properly adjusted. The ringer is adjusted in production and should not require adjustments in normal field use. However, should adjustments become necessary, the following procedure should be followed:

(1) Operate the clapper manually. It should strike the gong projections and rebound and come to rest with a slight clearance between the clapper and nearest gong projection.

(2) If the condition in (1) above does not exist, loosen the two gong-clamping screws and rotate the gong until the clapper strikes each gong projection equally.

(3) If the travel of the clapper is not sufficient or is

excessive, remove the gong and increase or decrease the armature travel by means of the two adjusting nuts located at the end of the magnet opposite the clapper end of the magnet.

(4) If the ringer cannot be adjusted by the above means, it may be necessary to bend the rod on which the clapper is mounted.

(5) When the clapper is moved manually as stated in (1) above, it should only be necessary to move the clapper part way as the magnet should pull the clapper against the opposite gong projection. If this does not occur it indicates that the magnet is weak and that the ringer should be replaced.

(6) The resistance of each ringer coil is approximately 650 ohms (1300 ohms for the two in series). A deviation of 15 percent or more from these values indicates a defective coil.

(7) The ringer should operate on a current of 6 milliamperes at 16 to 20 cycles per second. A greater current requirement indicates a defective ringer.

12. Capacitors CA-177-A and CA-209. The Capacitor CA-177-A is .5-microfarad capacity and one of its purposes in the circuit is to prevent direct current from flowing through the handset when the telephone is connected to common-battery lines. Another purpose is to limit the amount of 16-cycle ringing current through the handset and thereby eliminate the necessity for a switch on the handset. The Capacitor CA-209 is 1.9-microfarad capacity and is connected in series with the ringer. Its purpose is to prevent direct current from common-battery lines from magnetizing the ringer coils in such a way as to interfere with the proper operation of the ringer and to prevent the ringer from interfering with direct-current supervision on common-battery lines.

13. Circuits. See Figures 6 and 7. A wiring diagram and a schematic diagram are pasted on the metal telephone box and may be viewed by removing the leather case. The characteristics of individual circuits and equipment are described in detail in paragraphs 8, 9, 10, 11 and 12. These circuits may be summarized as follows:

a. The handset is connected to the line terminals through a .5-microfarad capacitor.

b. The ringer is connected to the line through the shunt springs of the generator and a 1.9-microfarad capacitor.

c. The generator is connected across the line only when the generator crank is being rotated. This same action disconnects the

telephone ringer at the generator shunt springs.

SECTION IV

SUPPLEMENTARY DATA

14. Power Levels. As stated in paragraph 1, Telephone TP-3-T1 may be connected to magneto or common-battery switchboards. However, in most cases, due to cross talk, it will not be practical to use sound-powered telephones when connected to the same switchboards to which are connected battery-powered telephones. The cross talk will be due to the fact that battery-powered telephones operate at a much higher power level than sound-powered telephones. Data on the power levels concerned are listed below.

<u>Decibels</u>	<u>Milliwatts</u>	
0	6.0	} Output range of battery-powered telephones.
-8	1.0	
-33	.003	} Output range of sound-powered telephones.
-38	.001	
-41	.0005	Minimum signal utilized by battery-powered telephones.
-43	.0003	} } Sensitivity range of receivers of battery-powered telephones.
-53	.00003	
-56	.000015	} } Range of noise caused by carbon transmitters of battery-powered telephones.
-63	.000003	} } Sensitivity range of receivers of sound-powered telephones.
-80	.00000006	} } Range of cross talk caused by battery-powered telephones.

15. Talking and Ringing Range. The talking and ringing range of the telephone varies with the type of line used, the insulating properties of the wire, and the condition of all splices, whether the wire is dry or wet, and whether it is on the ground or in the air.

As a general statement, the estimated talking range over Wire W-110 is five miles or more. The ringing range greatly exceeds the talking range. Therefore the talking limits will determine the field of usage for this telephone.

16. List of Parts.

<u>Quantity</u>	<u>Nomenclature</u>	<u>Stock Number</u>	<u>Weight Each (Pounds)</u>
1	Case, leather, SC-D-1784		1.5
2	Screws, machine, brass, binding-head, #6-32x1/2", dull black finish (for case), Item 7, SC-D-1783		
5	Screws, machine, brass, flathead, #6-32x7/16", dull black finish (for case), Item 6, SC-D-1783		
1	Strap, carrying, 48" long, Item 3, SC-D-1786		0.2
2	Rivets, copper, flathead, 3/32" by 3/8" long		
2	Burrs, copper, standard for 3/32" rivet		
1	Strap, carrying, 20" long, with buckle, Item 2, SC-D-1786-B		0.2
2	Rivets, copper, flathead, 3/32" by 3/8" long		
2	Burrs, copper, standard for 3/32" rivet		
1	Handset TS-10, specification No. 71-703 consisting of:		1.6
	1 Handle		.4
	1 Nameplate		.05
	2 Screws, machine, brass, #4-40x3/16", nickel-plate finish		
	1 Transmitter Unit		.26
	1 Mouthpiece, transmitter		.06
	1 Clamping Ring for above		.09
	1 Receiver Unit		.27
	1 Cap, receiver		.05
	1 Clamping Ring for above		.09
	1 Cord		.31
	1 Packing Gland Nut		.02
1	Capacitor CA-177-A, 0.5-microfarad	3D177A	.1
1	Capacitor CA-209, 1.9-microfarad		.3
1	Generator GN-38	4B838	2.3
1	Crank GC-9		.06
2	Binding Posts	3Z245	.05
1	Ringer MC-131	4B3371	.8



Fig. 1

SIGNAL CORPS LABORATORIES, FORT MONMOUTH, NEW JERSEY.

DATE	10-10-38	NO.	38-83-A	TITLE:	TELEPHONE TP-3-T1, READY FOR TRANSPORTATION
------	----------	-----	---------	--------	---

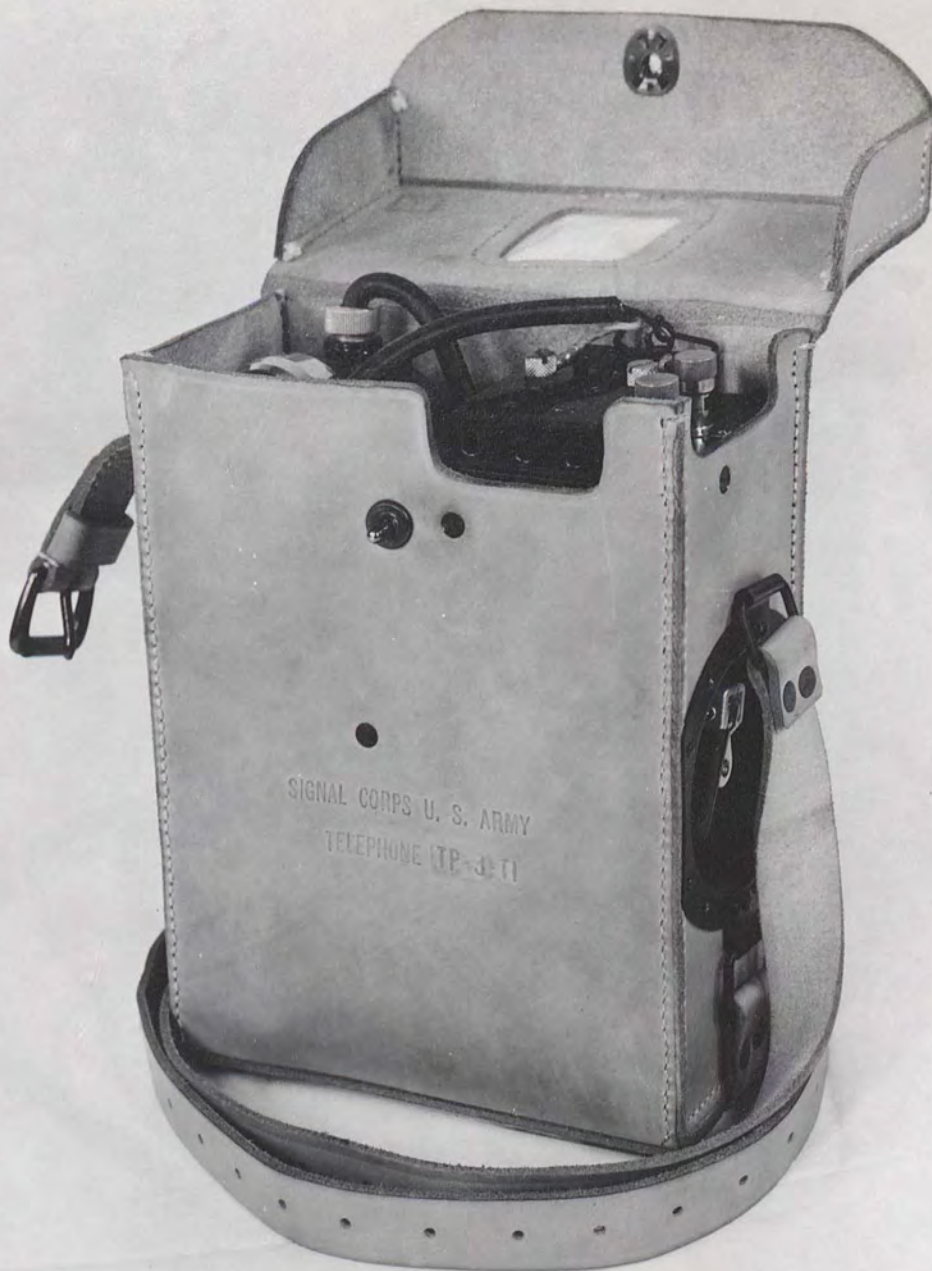


Fig. 2

SIGNAL CORPS LABORATORIES, FORT MONMOUTH, NEW JERSEY.

DATE 10-10-38

NO. 38-83-B

TITLE: TELEPHONE TP-3-T1, COVER OPEN
SHOWING HANDSET TS-10 IN
HANDSET COMPARTMENT



Fig. 3

SIGNAL CORPS LABORATORIES, FORT MONMOUTH, NEW JERSEY.

DATE	10-10-38	NO.	38-83-C	TITLE:	TELEPHONE TP-3-T1 SET BOX AND HANDSET TS-10 REMOVED FROM CASE
------	----------	-----	---------	--------	---



Fig. 4

SIGNAL CORPS LABORATORIES, FORT MONMOUTH, NEW JERSEY.

DATE

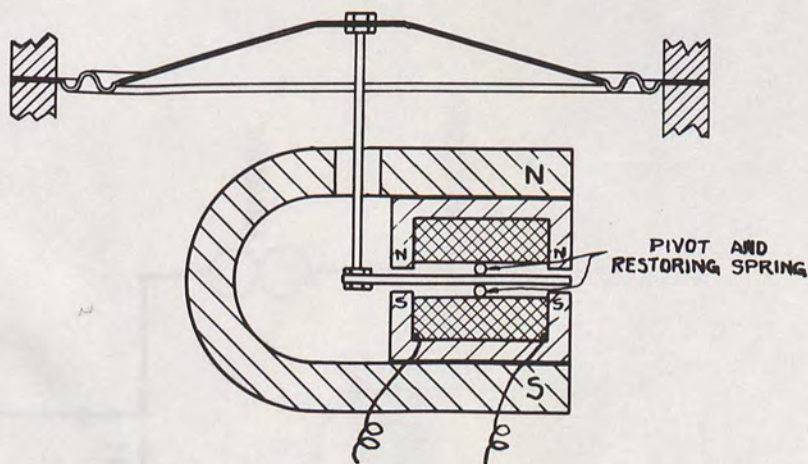
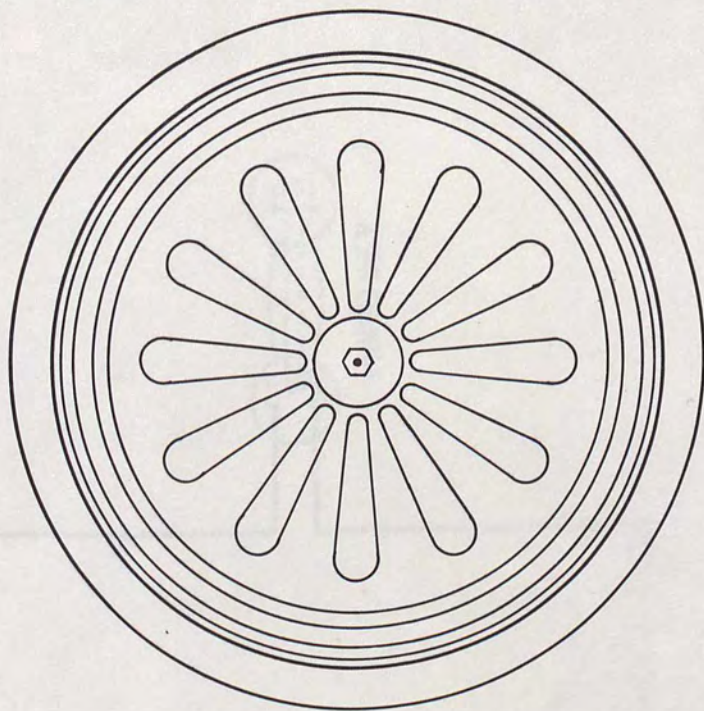
10-10-38

NO.

38-83-D

TITLE:

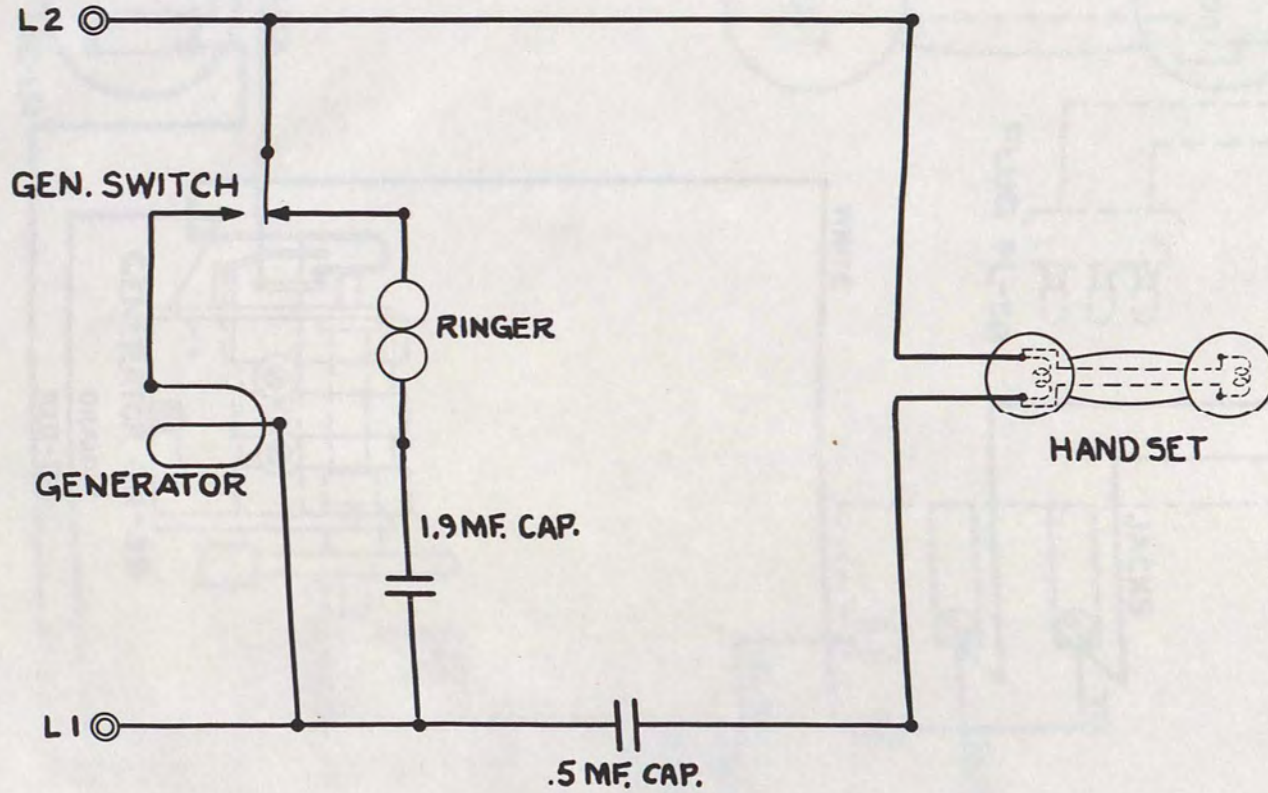
TELEPHONE TP-3-T1,
DISASSEMBLED



TELEPHONE TTS 3 PLACEMENT COVER

SCHEMATIC SOUND
POWERED UNIT
FIGURE 5

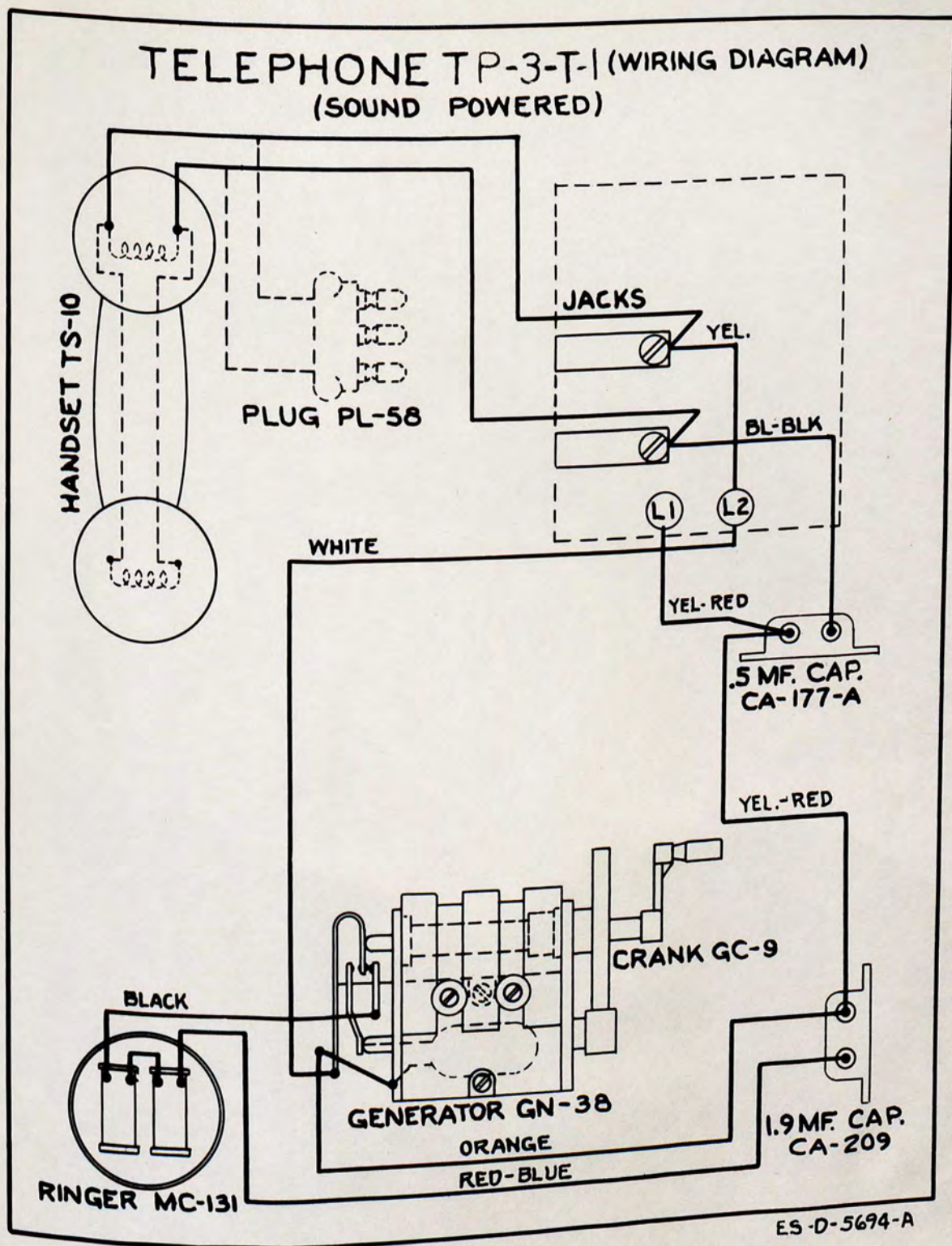
TELEPHONE TP-3-T-1 (SCHEMATIC DIAGRAM)
(SOUND POWERED)



ES-D-5694-A

FIGURE 6

TELEPHONE TP-3-T-1 (WIRING DIAGRAM) (SOUND POWERED)



ES-D-5694-A

FIGURE 7

